Brine Dewatering Using Ultrasonic Nebulization

UMPQUA Research Company

Technical Abstract

Recovery of water from brine is critically important for future manned space exploration. Resupply of water is prohibitively costly for such extended missions. Water reclamation processes typically recover 90-95% of the water present in wastewater formed by combining urine, hygiene water, and humidity condensate with the remaining concentrated in brine. This concentrated brine contains a significant amount of water, potentially a very valuable resource. The proposed prototype development will recover virtually all of the remaining water using an ultrasonic brine dewatering system (UBDS). In the UBDS process, extremely small nebulized droplets of the brine are created ultrasonically at the brine air interface. Small droplets enable quicker drying due to their high relative surface area. This is particularly important when drying brines that contain thermally labile materials, which require relatively low temperature drying. The UBDS prototype has no nozzles to become plugged, requires little power, is simple and small, requires minimal astronaut attention and is compatible with continuous, closed cycle operation that can be made gravity independent. The innovative Phase 2 prototype will fulfill the unmet need to significantly improve water loop closure during extended manned missions. The Phase 2 project will provide an automated UBDS prototype that will be delivered to NASA for further testing.

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2008 Phase II
Proposal X2.03-8729

Spacecraft Habitation and Waste Management Systems

A Compact, Efficient Pyrolysis/Oxidation System for Solid Waste Resource Recovery in Space

Advanced Fuel Research, Inc.

Technical Abstract

Pyrolysis processing can be used in near term missions for volume reduction, water recovery (drying), stabilization, and enhanced water and oxygen recovery through thermochemical reactions. For longer term missions, the added benefits include production of fuel, multi-purpose carbon, and reactants for in-situ resource utilization (ISRU). The objective of the Phase I SBIR program was to demonstrate the feasibility of integrating pyrolysis, tar cracking, and oxidation steps into a compact, efficient, system for processing spacecraft solid wastes. This integration, which was based on a microwave pyrolysis/cracking/oxidation unit, has resulted in a significant reduction in energy consumption per gram (~70% when compared to a conventional unit), and an overall reduction in system complexity. These improvements should lead to a lower Equivalent System Mass (ESM) for a full scale system. Under Phase II, a prototype microwave pyrolysis/tar cracking/oxidation unit will be developed in collaboration with ETM Electromatic, Inc., a leading manufacturer of microwave power systems for commercial, space and military markets.

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SBIR